Chapter 9
Proposal of Social Indicators to Assess the Social Performance of Waste Management Systems in Developing Countries: A Brazilian Case Study

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Abstract The Brazilian National Solid Waste Policy Law promotes sustainable integrated solid waste management nationally, and is committed to improve "informal" recyclable waste pickers' socio-economic conditions. This has led municipalities to develop waste management strategies to incorporate "informal" waste pickers into the "formal" system. In order to measure the social improvement achieved by this action, it is necessary to define a set of indicators capable of quantifying the social performance of waste management systems that adapt specifically to developing countries.

In this study, a set of social impact categories, indicators and metrics capable of assessing the socio-economic and labour conditions of the different stakeholders involved in the life cycle of a municipal solid waste management (MSWM) system is proposed. Then they are applied to a case study in the city of João Pessoa, Paraíba (Brazil). João Pessoa is one of the pioneering Brazilian cities to incorporate a door-to-door selective waste collection system managed by the previous "informal" waste pickers, reorganised into associations or cooperatives of collectors of recyclable materials. Although this waste collection system has steadily expanded around the city until the present-day, it has never been analysed from a social perspective.

Keywords Waste management · Social life cycle assessment · Developing country · Social indicator

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9.1 Introduction

Waste management covers a vast field of human activities which, in developing countries, share some similarities to their social singularities, such as limited participation in selective collection programmes, or waste pickers' poor socio-economic and labour conditions [1].

By taking Brazil as a case study, the National Brazilian Solid Waste Policy Law [2] encourages sustainable integrated solid waste management nationally by improving the working conditions of informal waste pickers by integrating them into formal waste picker cooperatives [3]. Among other actions, this aims to improve the social performance of the Municipal Solid Waste Management (MSWM) systems.

To assess and improve MSWM systems in developing countries, it is necessary to evaluate them from a life cycle perspective, including the assessment of social aspects [4]. However, no consensus has been reached for the social impact assessment method, neither in the impact categories to be used, nor in the stakeholders to be considered [5]. Therefore, in order to analyse the social performance of MSWM systems, it is necessary to define an adequate set of social categories, indicators and metrics and the groups of stakeholders to be taken into account.

With this context in mind, the present research aims to propose and apply a set of social indicators capable of assessing the socio-economic and labour conditions of the different stakeholders involved in the life cycle of an MSWM system in developing countries in general, and in Brazil in particular. To do so, a set of social impact categories, indicators and metrics is proposed after taking into account the needs and characteristics of developing countries and the conclusions drawn from a literature review of social impacts caused by waste management activities worldwide. These proposed social indicators were applied to a case study in João Pessoa (Brazil).

9.2 Methodology

The methodology used for proposing and applying to the case study a set of social indicators and metrics to assess the social performance of MSWM systems in developing countries in general, and in Brazil in particular, consists in the stages showed in Fig. 9.1 and described below.

1. A literature review that focuses on analysing the social impact categories/indicators of system in order to identify those more commonly applied. It has been mostly observed that the reviewed studies are based on the methodological framework proposed by UNEP-SETAC [6, 7].
2. A literature review that focuses on analysing MSWM systems in order to identify the stages, the involved stakeholders, socio-economic and labour conditions, needs, etc. of MSWM systems implemented in developing countries in general, and in Brazil in particular.

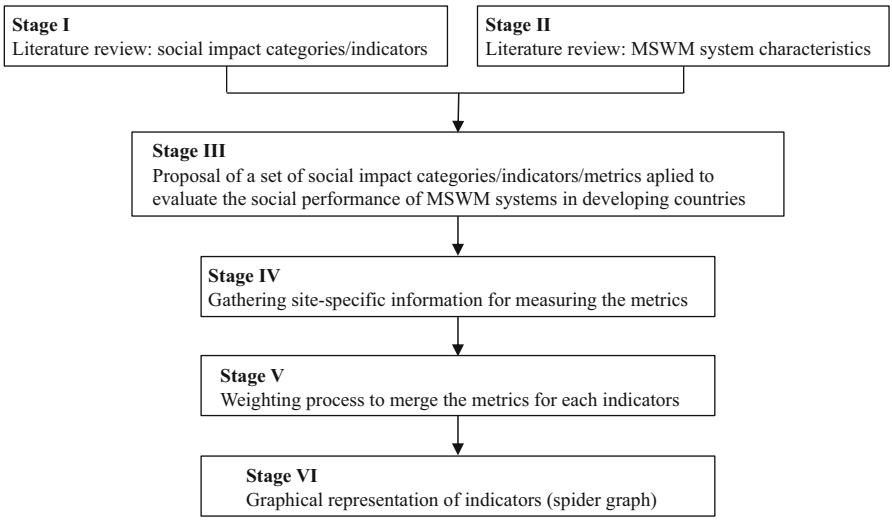

Fig. 9.1 Methodology

3. Proposing a set of social impact categories, with their corresponding indicators, capable of assessing the socio-economic and labour conditions of the stakeholders involved in the life cycle of an MSWM system by taking into account the information from Stages I and II. In order to quantify each indicator, metrics and data source were proposed for each stakeholder that affects it. A set of 12 social impact categories and 22 indicators, with their corresponding metrics, are suggested (for details see Table 9.1).
4. Gathering site-specific information for each metric to apply the proposed social impact categories and indicators to the case study. To do this, questionnaires have to be specifically devised for each group of involved stakeholders.
5. A weighting process need to be applied to merge the metrics for each indicator. A multi-criteria decision analysis is recommended to take into account different preferences for the various social impact categories/indicators [8].
6. The calculated social indicators can be graphically represented to facilitate the identification of the social impact categories/indicators that perform better or worse, or to compare different case studies. To do this, spider graphs may be represented by considering that the bigger the drawn area, the better the system's performance. That is to say, the best social performance of a category would receive the maximum score (100%) and would be plotted on the more external line of the spider graph.

Table 9.1 Proposal of social indicators to assess waste management systems

Social impact category	Social indicators	Metrics	Stakeholder groups			Data source		
			workers	Users	Municipal authorities	Primary data (questionnaire)	Primary data (visits)	Secondary data
1. Working rights	1.1 Freedom for association and collective bargaining	1.1.a Evidence for restrictions to the freedom of association and collective bargaining	•			•		•
		1.1.b Workers have access to meetings and the possibility to dispute resolution procedures	•			•		
		1.1.c Labour union presence	•			•		•
2. Human rights	2.1 Child/senior labour	2.1 Number of children working in the analysed sector	•			•		
3. Quality of job positions (working conditions)	3.1 Fair salary	3.1 Worker salary compared to minimum wage	•			•		
	3.2 Working hours and/or weekly rest	3.2 Weekly hours actually worked by employees	•			•		
4. Equal opportunities / discrimination	4.1 Gender discrimination	4.1.a Number of women working in waste management	•			•	•	
		4.1.b Gender pay gaps	•			•		
	4.2 Labour regulation	4.2 Number of undocumented workers in waste management	•			•		•
	4.3 Workers from marginal classes	4.3% of workers with no possibility of working in another sector	•			•		
5. Health & safety	5.1 Security & safety for workers	5.1% of workers who use PPEa in their work	•			•		•
	5.2 Long-term health	5.2.a % of vaccinated workers	•			•	•	
		5.2.b % of workers with no health problem	•			•		

6. Working benefits	6.1 Legal employment with social benefits/ security	6.1% of workers with information on the rights that correspond to the waste collector occupational code	•			•		
	6.2 Workers and relatives with health insurance	6.2% of workers with the possibility of paying the NHSb	•			•		•
7. Socio-economic conditions	7.1 Level of education: Workers and their children	7.1.a Workers' level of education	•			•		
		7.1.b Level of education of workers' families	•			•		
	7.2 The population's social characteristics	7.2.a Total monthly family income	•			•		•
	7.3 Safe and healthy living conditions (access to material resources)	7.3 Quality of workers/customers' houses	•			•	•	
8. Community satisfaction & participation	8.1 Customer/citizen satisfaction	8.1 Social welfare/satisfaction (quality of products/service)		•		•	•	
	8.2 Customer/citizen participation	8.2% of citizens with access to a reliable WM system		•		•		
9. Value chain actors relationship	9.1 Transparency/ corruption	9.1.a Customer knowledge about the system		•		•		
		9.1.b Presence of periodical public company reports			•			•
10. Professional development	10.1 Degree of environmental worker awareness	10.1 Workers' environmental education/awareness	•			•		

(continued)

Table 9.1 (continued)

Social impact category	Social indicators	Metrics	Stakeholder groups			Data source		
			workers	Users	Municipal authorities	Primary data (questionnaire)	Primary data (visits)	Secondary data
11. Local development (socio-economic repercussion)	11.1 Development of environmental awareness and responsibility	11.1.a Custom environmental awareness		•		•		
		11.1.b % of users receiving environmental information on waste management		•		•		•
	11.2 Local labour integration of formal workers from the informal sector	11.2% of formal workers from the informal sector	•			•		•
12. Governance	12.1 Public commitments to sustainability issues	12.1% of actions made with public funds related to waste management		•	•	•		•
	12.2 Maturity (existence of informal WM system's regulation)	12.2 Legislation on waste management			•			•

[a]PPE – Personal Protective Equipment
[b]NHS - National Health Service

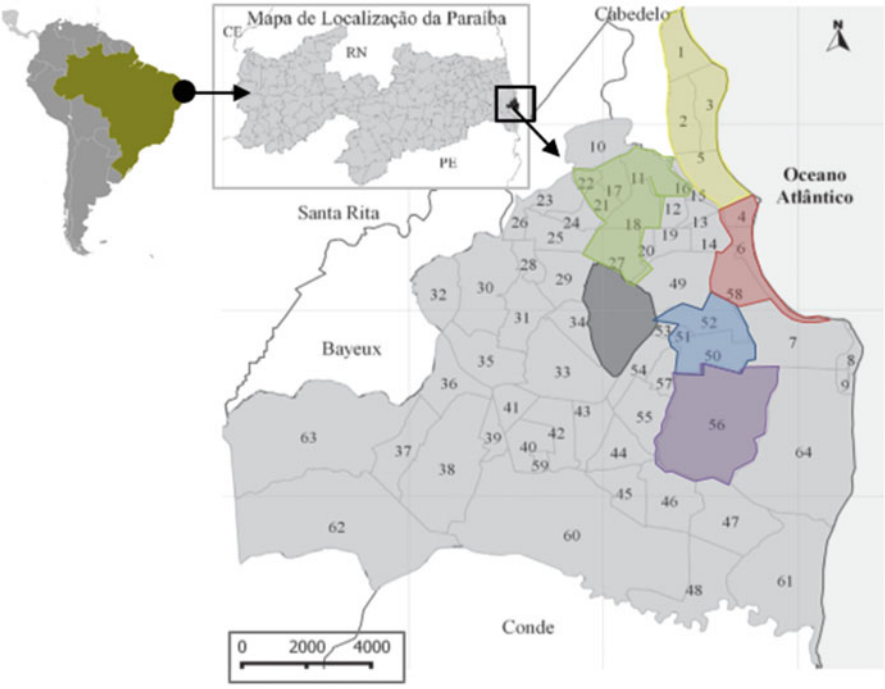

Fig. 9.2 Location of João Pessoa and its districts (Brazil)

9.3 Case Study

The proposed methodology was applied to a case study in the Brazilian city of João Pessoa, whose population (791,000 inhabitants) produces more than 247,000 tons of municipal solid waste per year [9]. The MSWM system in João Pessoa has progressively incorporated a selective collection programme since 2003 [10]. Consequently, different informal waste pickers who previously collected recyclable materials in open dumps have been reorganised in associations that are in charge of door-to-door recyclable material collection and of the manual segregation of recyclable materials in a new manual Material Recovery Facility (MRF) located next to the sanitary landfill. See Fig. 9.2.

To apply the methodology, the site-specific data needed to quantify each metric were collected from the involved stakeholders: workers (waste pickers), users (waste producers) and municipal authorities. To this end, questionnaires were designed for each stakeholder group and were tested by a small sample of surveyed individuals to see if the language was comprehensible, if the response options were suitable and if the necessary information for quantifying the indicators was acquired. Moreover, additional information was obtained from the observations made when visiting the facilities.

The obtained results are presented in Fig. 9.3.

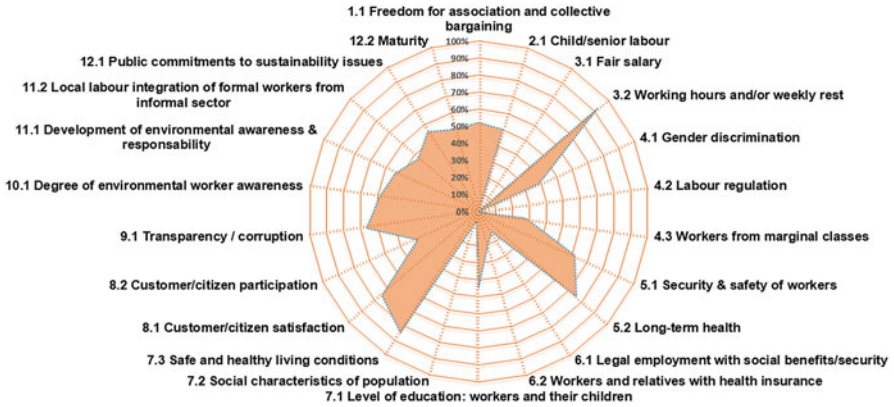

Fig. 9.3 Proposal of the social indicators to assess waste management systems

9.4 Conclusions

The proposed methodology allows the social performance of waste management systems in developing countries to be assessed. This methodology is based on a proposal of social impact categories, and indicators and metrics that facilitate their quantification.

The proposed social impact categories and indicators were applied and validated to the case study of the city of João Pessoa (Brazil). The obtained results demonstrate how the social performance of the MSW management system in João Pessoa still has room for improvement from a social point of view. The better performing social indicators are "Working hours and/or weekly rest" and "Safe and healthy living conditions", followed by "Customer/citizen satisfaction". The worst performing social indicators are "Labour regulation" and "Fair salary", followed by "Social characteristics of population" and "Legal employment with social benefits/security".

Although it has been demonstrated that the proposed social impact categories and indicators are practicable and successful for identifying key aspects and for extending knowledge on the social performance of the MSW management system in the case study, some suggestions for future development are identified. Analysing not only the social characteristics of workers and their families, but those of the users involved in the waste management system, and of the local communities living next to the facilities involved in the system, seems interesting to obtain in-depth knowledge about the effect of the system on its backyard. In line with this, adding an impact category related to some physical impacts, generally considered environmental aspects (e.g. noise, odour, visual impact, etc.), could provide profound knowledge about the analysed systems as these aspects could be important for waste management sites to be accepted by neighbourhoods. Finally, more information about workers' living conditions, such as house size or the security at home, would provide a more detailed picture of the "safe and healthy living conditions"

indicator. In addition, previous training about aspects related to occupational diseases, occupational safety and health measures, etc., is highly recommendable to ensure that waste workers correctly understand the questionnaires.

The proposed social impact categories and indicators allow the identification of both the social issues and social benefits associated with the inclusion of the informal waste management sector in municipal management strategies in developing countries, which can help in the decision making that forms part of steering municipal programmes for social performance improvement.

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